Aeroelasticity Assignment No. 5

5:00 PM

Due: December 16 (Fri) 6:00 PM

1. Consider a 24-bladed rotor of airfoils operating at low speed (see Fig. 1). Model the cascade as an infinite row of two-dimensional flat plates operating at zero mean incidence. Compute the aerodynamic influence coefficients for bending vibration of the airfoils using a vortex-lattice model as described in class. Is the tuned system stable or unstable?
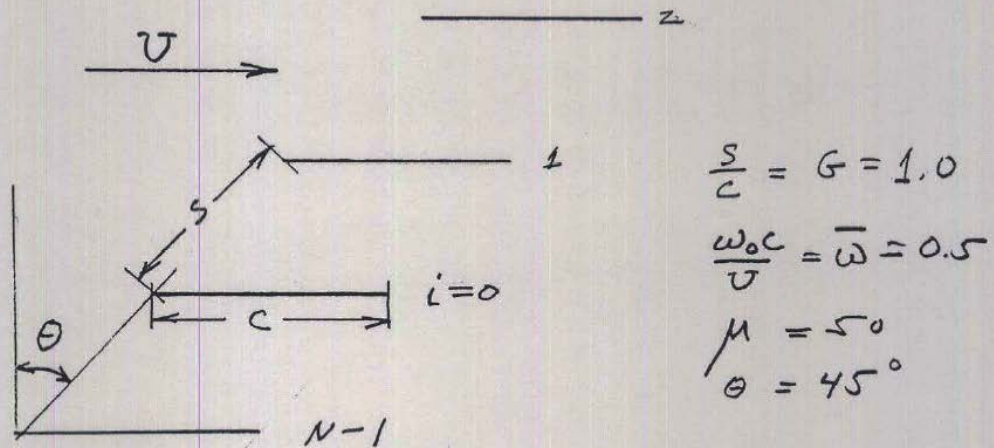

$$\frac{s}{c} = G = 1.0$$

$$\frac{\omega_0 c}{U} = \bar{\omega} = 0.5$$

$$\mu = 50$$

$$\theta = 45°$$

Figure 1. Cascade of flat plate airfoils.

2. Now consider the case where the rotor is alternately mistuned in mass so that

$$m_i = m_0 \left[1 + (-1)^i \epsilon\right]$$
$$k_i = k_0$$

where $\epsilon = 0.1$. Compute the eigenvalues of this mistuned system. Compare your results to the eigenvalues of the tuned system.